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Delivering Hurricane Isabel to the Media



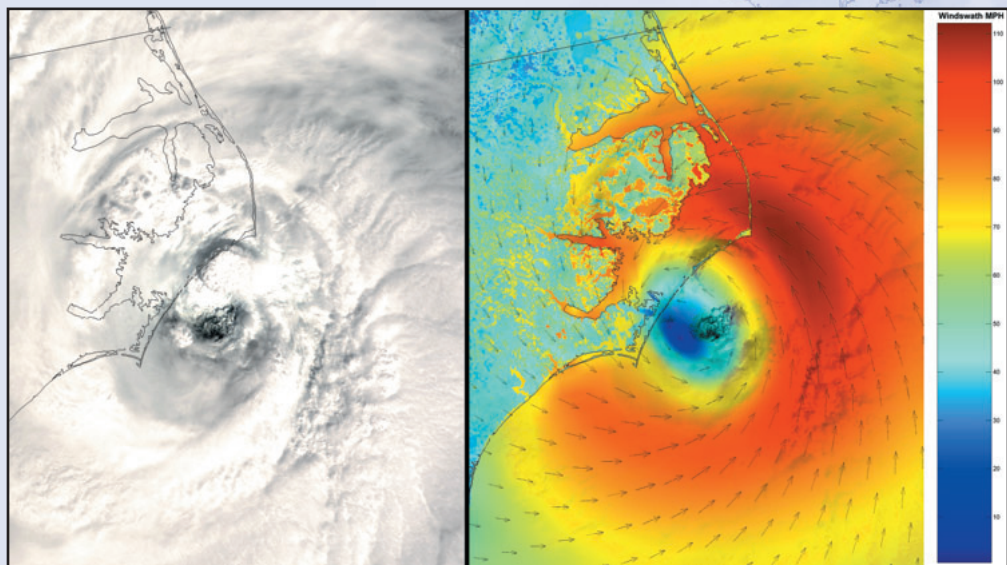
In the Path of Disaster . Delivering Hurricane

Dave Jones

When Hurricane Isabel approached the U.S. East Coast on September 8, 2003, StormCenter Communications went into "storm mode," continuously monitoring Isabel using data and images from earth-orbiting satellites, Air Force reconnaissance reports, buoy observations, and numerical forecast model outputs. From these resources multiple **Envirocast** updates were produced daily. Envirocast is StormCenter's new rapid response delivery tool for the media to quickly distribute NASA, NOAA, and commercial sector satellite imagery that has been processed and enhanced for television broadcast as well as for Internet web site use. The results were exceptionally well-received.

According to CBS11 KTVT Chief Meteorologist Kristine Kahanek in Dallas, Texas: "The images are not only spectacular, but very timely and well-documented with detailed information to help us explain to our viewers what they are seeing . . . I have had a lot of positive feedback about the quality and detail of our entire presentation, especially during the lifecycle of Hurricane Isabel. Envirocast has become another reliable information resource for us that is media-ready and fun to use!"

When a hurricane develops, it is the media's job to inform viewers of its progress and to report the official advisories prepared by the National Hurricane Center. Official forecasts then become the basis for the television weathercaster to discuss potential impacts and preparation plans. The local on-air meteorologists and news teams are where the public turns for weather updates, particularly when severe weather threatens.



Side by side visualization of Isabel making landfall on the Outer Banks of North Carolina (left) with RealTrack forecast Wind swath (right)

Television news executives have professed that "a story is not a story without pictures." The media, particularly meteorologists, need pictures or images of a storm to begin to discuss the situation and inform the public as accurately as possible. Satellite images help to show the dimensions of a storm, its geographic location, movement, predicted track, and even storm evolution. And when typical satellite images and storm track maps are enhanced with innovative and even more informative graphics, the forecasters and their viewers are quick to take notice.

Recognizing this, StormCenter has embarked on a major effort to supply such graphics and visualizations to the media. These graphics are generated in-house or obtained from other sources, for example NASA, Earth Science Enterprise (ESE), the Federation of Earth Science Information Partners (ESIP Federation), universities, and other government agencies. These data are reformatted and enhanced with value-added information and processing. StormCenter's success with Hurricane

Isabel illustrates the benefits to the media and those that regularly produce relevant data and images.

Hurricane Isabel

The National Hurricane Center (NHC) in Miami, Florida issued its first public advisory on Tropical Storm Isabel at 9am EDT on September 6, 2003. Two



CBS11 KTVT in Dallas, Texas Chief Meteorologist Kristine Kahanek displays an Envirocast image from NASA's Modis sensor on board the Terra satellite.

Isabel to the Media

days later, at 11am EDT on September 8, 2003, Isabel became the fourth hurricane of the season. Although she was not a threat to land at that time, nature was at work generating her own weapon of mass destruction.

Hurricane Isabel continued to develop and became the second major hurricane to form in the Atlantic basin in 2003. A major hurricane is defined as one with winds in excess of 111 mph, a category 3 storm on the 1 to 5 Saffir-Simpson Scale. Aided by warm sea surface temperatures and a favorable environment for strengthening, Isabel obtained what few hurricanes have ever done in the Atlantic. At 5pm EDT on September 11, 2003, she achieved category 5 status with winds in excess of 155 mph. The last Atlantic basin hurricane to reach such intensity was hurricane "Mitch" in 1998.

As Isabel grew in intensity, and continued to move toward the west-northwest, the media, the public, and decision makers from Miami to Boston intensified their monitoring. There were concerns surrounding coastal erosion, evacuation, relocation of military ships, cruise ships, and planes, as well as the potential economic and environmental impacts. And all the while, Isabel behaved remarkably well, plodding along toward the U.S. East Coast.

Over the past 40 years, the East Coast has been spared the brunt of many tropical storms and hurricanes. Prior to that time, in the 1940's and 50's, major storms were etched in the record books with the likes of Carol, Diane, Hazel, and others. Still Floyd, Hugo, and Andrew in recent years, and the great 1938 hurricane, also known as the "Long Island Express" that slammed into New England, are reminders that the East Coast is not immune to a disaster borne of the sea.

In Maryland, hurricanes are a rarity. In fact, only once in recorded history has

a hurricane ever hit the state. A 1933 hurricane struck nearby Virginia, weakening as it moved northward. Still, the wind and wave action was strong enough to create an inlet at Ocean City, Maryland. Once formed, the inlet was kept open by the Army Corps of Engineers and became a boon for the locals. As a result, Ocean City is now a major fishing and tourism town.

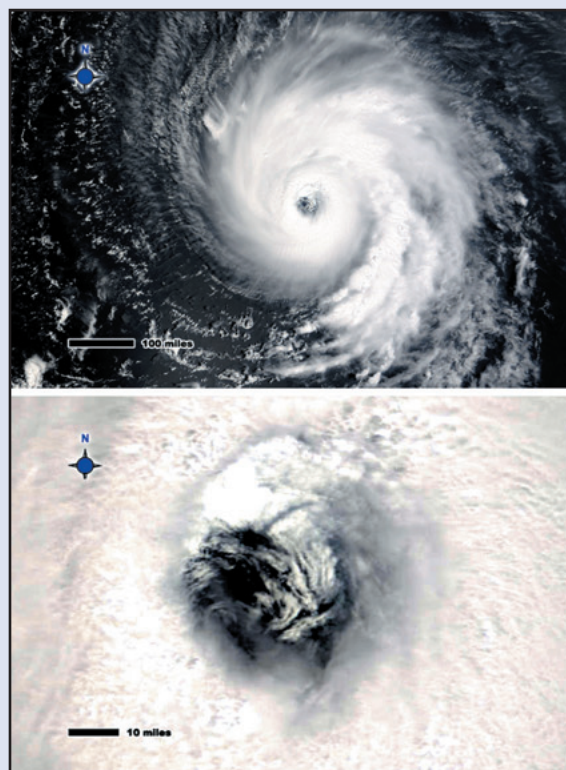
NHC's official forecast of Hurricane Isabel's track was very good, in large part because Isabel was a "well-behaved storm . . ." This excerpt from their discussion four 4 days prior to landfall shows just how "on-target" their forecasting was:

" . . . Landfall along the U.S. Mid-Atlantic coast somewhere between North Carolina and New Jersey between four 4 or 5 five days is appearing more and more likely . . ." *Source: NHC Hurricane Isabel discussion at 11am September 14, 2003.*

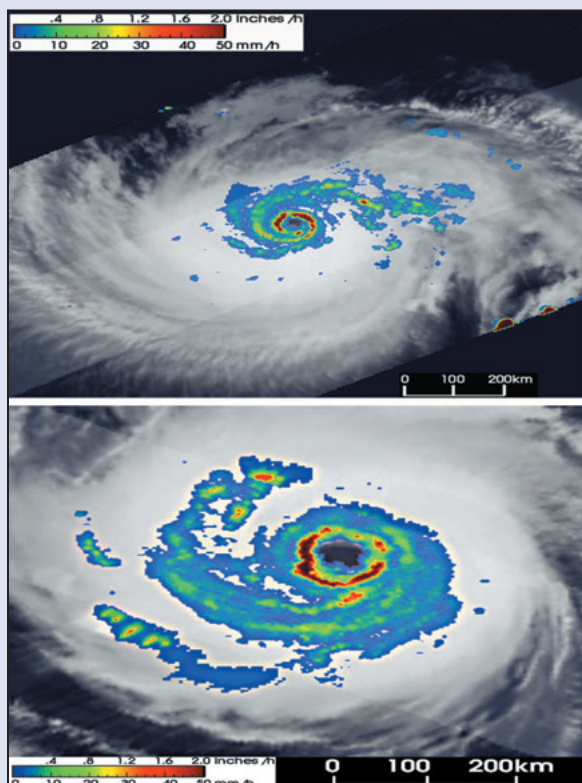
While Hurricane Isabel was approaching the coast of North Carolina, StormCenter's team was gathering data and images, reformatting them, adding content and explanations, and distributing this important content to the media. Because StormCenter had spent many years working with ESIP Federation members producing value added, satellite-derived products, the stage was set to deliver NASA data directly to the media during this critical period. During the week of Isabel, StormCenter had distributed unique high resolution images from NASA's Tropical Rainfall Measuring Mission (TRMM), NASA's Terra and Aqua flagship satellites using the MODIS, ASTER, and

AIRS sensors as well as images from the commercial remote sensing industry for post hurricane analysis on the Outer Banks of North Carolina. International Space Station images were also processed and appeared on newspaper front pages across the nation as well as on local weathercasts.

StormCenter also has access to operational, near-real-time NOAA satellites, which provide high frequency images at fairly high resolution. GOES has been the mainstay of weather satellites and provides the majority of television weather images for on-air animations. GOES now has the capability



(Top) Envirocast imagery of hurricane Isabel at 13:45 UTC (9:45 a.m. EDT) on September 8, 2003, as it was located approximately 1,265 miles east of the Leeward Islands, moving towards the west-northwest at 14 mph. (Bottom) A high resolution Envirocast image of Isabel's Eye from the MODerate-resolution Imaging Spectroradiometer (MODIS) onboard NASA's Terra satellite.



Envirocast image of NASA's TRMM satellite providing critical radar data of Isabel. This is the only way to see currently see rainfall intensity without flying into the storm. (Top) Hurricane Isabel on Sept. 10, 2003, as seen with the TRMM satellite. (Bottom) Hurricane Isabel as seen by TRMM on Sept. 12, 2003.

to go into "rapid scan" mode, a mode that allows for imagery capture in a specific narrow window every one 1 minute. This yields spectacular image "loops" of cloud motions and change. However, this can only be done for short periods of

time due to the reduced spatial coverage.

While forecasts of hurricane tracks have improved during the past decade, the ability to forecast hurricane intensity has changed little. And nowhere is this more important than in visualizing what might happen when a hurricane makes landfall. Many people have expressed interest in "seeing" what the wind field might look like once the storm nears and hits land.

Working to improve support to emergency managers, media, and the public, StormCenter recently joined forces with Accurate Environmental Forecasting, Inc. (AEF) in Narragansett, Rhode Island. As partners we will provide decision makers and the media with new and exciting hurricane model forecasts. The AEF "RealTrack" hurricane model was tested in a few select media markets in the path of Isabel and received very positive feedback. As

is evident in the images on the following page, the wind field is much easier to see than via conventional graphics.

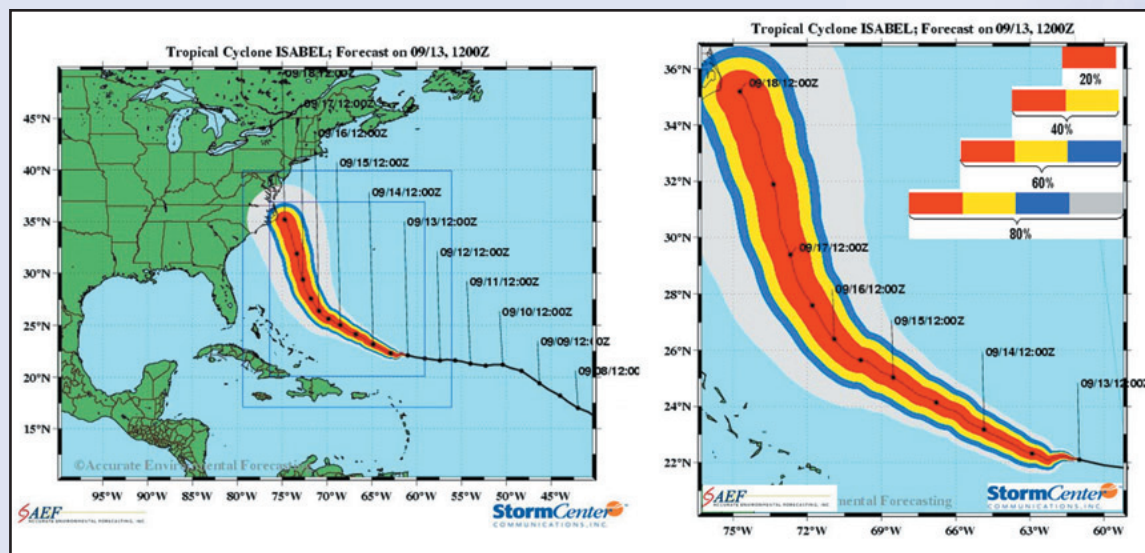
Greg Fishel, Chief Meteorologist at CBS affiliate WRAL-TV (Channel 5) in Raleigh, North Carolina said, "The

wind field output was amazing and incredibly detailed."

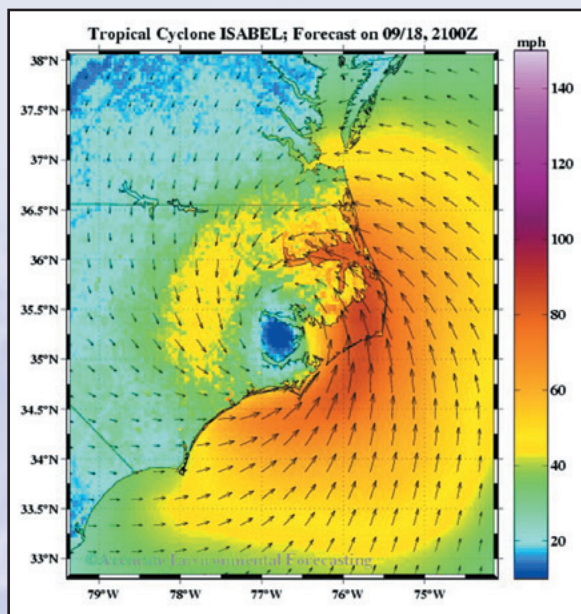
Bob Ryan, Chief Meteorologist at NBC owned WRC-TV (Channel 4) in Washington, D.C., praised the forecast product by saying, "I think it was terrific output and very useful, I'd like to investigate how we might use it for other storms... but no more Isabels please."

Part of the value of the AEF/StormCenter graphics is that new images and computer model output were delivered several times each day to keep television stations updated. The forecast model output delivers a track forecast and very detailed wind forecasts. This provides incredibly specific information to officials who need to determine if evacuations are warranted and if so, which locations and when. A very unique capability of this model is that it can be set to match the official forecast track issued by the National Hurricane Center. In this way decision makers see the official track forecast and a detailed wind field forecast as well. This has wide applications to decision makers everywhere.

The fact that it has been in use at the National Hurricane Center for the last five years gives it further credence as a forecast tool to assist in decision making. NHC has been using it as part of its watch and warning program. This capability and reliability is critical for decision makers in television, in local governments, and for the viewing public. The more we can get the public to understand the potential impacts of wind, surge, and rain—the more we can save lives.



This AEF/StormCenter forecast from September 13, 2003 proved to be quite accurate even five days ahead of landfall.



This AEF/StormCenter forecast from September 17, 2003 shows the incredibly detailed wind field circulating around Hurricane Isabel just after landfall. Output like this can be of great assistance to decision makers.

A Bevy of Resources

One of the critical pieces to the successful dissemination of enhanced information to the public during Hurricane Isabel was having credible sources with high quality, reliable data and imagery. For instance, imagery from the MODIS sensor on both NASA's Terra and Aqua satellites were available and used. As a founding member of the Federation of Earth Science Information Partners (esipfed.org), StormCenter also had access to resources within numerous government agencies, universities, non-profit organizations, and businesses through the ESIP Federation. This allows StormCenter to tap into the expert knowledge bases of very talented earth scientists, researchers, and educators. As a result, StormCenter's products are delivered with an incredible level of credibility that decision makers know they can trust.

Kristine Kahanek reiterated her support for StormCenter's ability to deliver science-based imagery and information this way: "... I feel good knowing that we are giving our viewers something they won't see anywhere else and the science behind the visual as well ..."

Imaging After Isabel's Assault

At least 40 deaths have been attributed to Hurricane Isabel after the category 2 storm slammed ashore on the Outer Banks of North Carolina on September 18, 2003 around noon. Many of these deaths occurred from North Carolina to Maryland due to falling trees and accidents. Winds gusted unofficially to 108 miles per hour in Kitty Hawk and waves topped 30 feet in some locations. Isabel inflicted tremendous damage on the central North Carolina barrier island chain. Some homes were swept from the beach side into Pamlico Sound while others simply collapsed onto the seaward beaches.

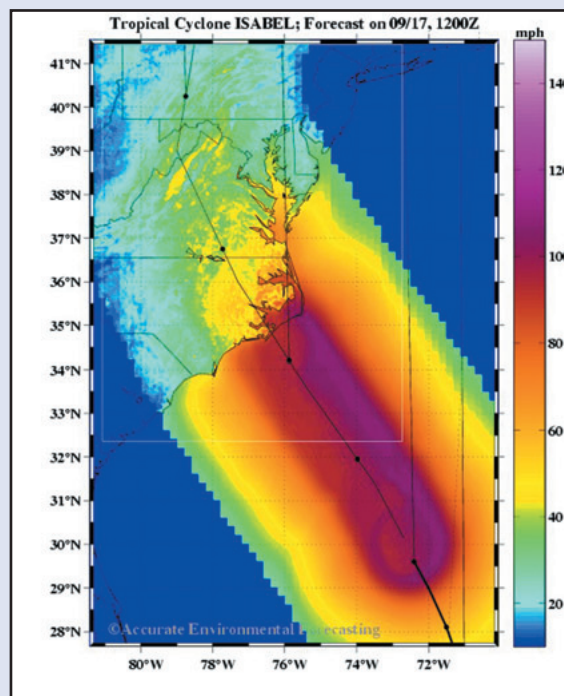
If Isabel had been a category 5 hurricane at landfall catastrophic damage would have occurred. Fortunately she weakened from her earlier category 5 intensity to a category 2. Only three hurricanes have hit the U.S. mainland with category 5 status: the 1935 Florida Keys Hurricane, Hurricane Camille in 1969 which hit Gulfport, Mississippi, and recently upgraded Hurricane Andrew which struck just south of Miami in 1992.

Television meteorologists were also able to immediately identify what had changed following the passage of Hurricane Isabel thanks to images provided by Space Imaging, Inc. StormCenter reformatted Space Imaging's standard imagery, added key geographical landmarks and incorporated descriptive information. Then the images were delivered via StormCenter's Envirocast software for use immediately on-air. By acquiring high resolution imagery before and after Isabel, meteorologists were able to show their viewers the impact of Isabel's coastal assault.

Greg Fishel immediately used the imagery as a way to communicate the power of satellites and as a way to monitor changes in landscape due to hurricanes.

For StormCenter, Isabel was a true test of a concept that has been building for several years. A team of image processing and GIS specialists, meteorologists, and environmental educators pulled together critical information and prepared focused descriptions that explained the significance of the satellite imagery and the potential environmental impacts as Isabel made landfall. This was exactly what TV meteorologists needed for their weathercasts. And due to years of relationship building the updates were sent directly to the television station weather offices for immediate use on-air. The sources of information were trusted and the imagery was used to inform millions of viewers.

In addition, StormCenter staff supported a major radio network with hourly Isabel updates from early morning to late at night at times reporting LIVE from shorelines along the Chesapeake Bay as a tidal surge of 8-11 feet moved up the Bay.



AEF/StormCenter wind swath visualization forecast from September 17, 2003 helped decision makers determine exactly where the highest winds would occur even far inland.



High resolution imagery shows the impact of Hurricane Isabel's assault on the Outer Banks of North Carolina. Image enhancements performed by StormCenter Communications, Inc. Image courtesy of Space Imaging, Inc.



WRAL-TV Channel 5 Chief Meteorologist Greg Fishel prepares to point out homes that were swept away by Isabel in Kitty Hawk, North Carolina. Note Space Imaging's imagery on monitor in background.

Looking Ahead


The 21st century offers great challenges and opportunities in global environmental monitoring and communications. Hurricane Isabel offered an opportunity to pull together the vast resources available at NASA and NOAA and showed just how research platforms that gather data and information for studying global change can be used for rapid response product generation in times of natural disasters. Most of these research tools on board NASA platforms will be implemented operationally when NPOESS, the nation's combined defense and operational meteorological satellites roll out in less than 10 years.

Working closely with NASA and other data sources enabled StormCenter to retrieve images quickly, as well as reprocess them while adding valuable information to the images for TV network affiliates. By redistributing these decision support products the process quickly proved its worth to millions of Americans. The people of the United States are hungry for information that will help them better plan their futures both immediate and long-term and this effort provided very understandable information.

StormCenter's goal is to deliver images that are compelling and can be communicated to millions of people in a way that can be understood quickly. During Hurricane Isabel images that were produced and sent to television stations were used on-air, reached millions, and increased the value of this information to the public and decision makers. It was a success for the entire remote

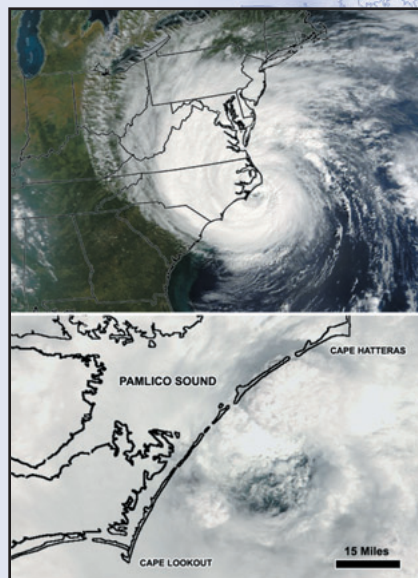
sensing industry, validating the utility of satellite products.

StormCenter staff faced an even bigger challenge in that they remained at their posts generating and delivering imagery and information even though they themselves were directly in the path of the storm, being based in Ellicott City, Maryland—just southwest of Baltimore. Still, they kept focused and ensured that media-ready images were distributed.

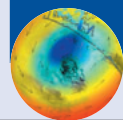
Hurricane Isabel was a dramatic example of how we can improve delivery and dissemination of important earth science information. At StormCenter we call this Envirocast, a new system to deliver information on a wide variety of significant and relevant topics, including winter storms, floods, fires, droughts, and other environmental hazards. Clearly, it is critical that the media be well-prepared to inform the public when it comes to communicating this type of information. 

About the Author

Dave Jones is Founder, President, and CEO of StormCenter Communications, Inc. (stormcenter.com). He is also President of the ESIP Federation (esipfed.org), and Chairman of the Board for the Foundation for Earth Science. Dave can be reached via e-mail at Dave@stormcenter.com



Hurricane Isabel's eyewall makes landfall between Cape Lookout and Cape Hatteras, North Carolina. This 250-meter resolution Envirocast image was acquired by NASA's MODIS sensor.



FEMA



Dare County, North Carolina City Manager



The house above collapsed on the Outer Banks of North Carolina due to the strong storm surge.

StormCenter Communications



The storm surge and pounding waves created new inlets cutting off residents to the south. Here, Highway 12 has been washed away.



Isabel claimed many homes on the beaches of North Carolina. This one in Kitty Hawk could not stand the force of the storm surge.



Above, Isabel produced record-breaking storm surges up the Chesapeake Bay in many locations. Pictured here is Fells Point, Maryland, flooded by the 7+ foot surge.

StormCenter Communications

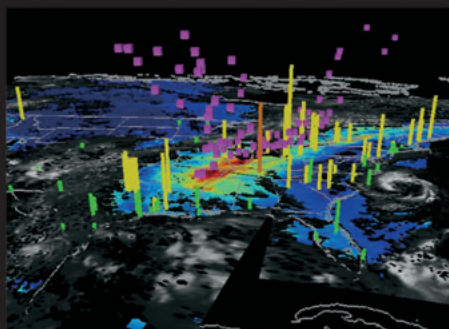


Isabel's storm surge sent water levels to 8 feet 6 inches above mean low water on the Magothy River in Anne Arundel County, Maryland. This marina is completely submerged under 5 feet of water.

International Space Station (ISS) astronauts captured this spectacular image of Hurricane Isabel far out to sea as a category 5 storm.

On the Cover: Enhanced image composition created by StormCenter Communications. The image consists of a NASA Terra satellite image of Hurricane Isabel making landfall on the Outer Banks of North Carolina on September 18, 2003, combined with data from AEF's RealTrack model forecast wind field showing the extent of hurricane force winds which plays a critical role in the support of decision makers such as emergency managers and the media.

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